REMARKS

The Office Action and the cited and applied references have been carefully reviewed. No claim is allowed. Claims 59-62, 65, 67-74, 81-84, 86 and 89-91 presently appear in this application and define patentable subject matter warranting their allowance. Reconsideration and allowance are hereby respectfully solicited.

The amendment to the claims to recite "at least two end portions, each being coupled to a corresponding nanozone" does not raise any new issue as this feature is recited in claims 87 and 88 (now cancelled in favor of incorporating this feature(s) into independent claim 59) and previously considered by the examiner.

Claims 65, 73 and 91 have been objected to because of informalities. This objection is obviated by the amendments to the claims.

Reconsideration and withdrawal of the objection are therefore respectfully requested.

Claims 65 and 67 have been rejected under 35 U.S.C. §112, second paragraph, as being indefinite. This rejection is obviated by the amendment to claim 67 to be dependent from claim 59.

Reconsideration and withdrawal of the rejection are therefore respectfully requested.

Claims 59, 60, 62, 65, 67, 68, 69, 70, 71, 73, 74, 82, 83, 85, 88, 90 and 91 have been rejected under 35 U.S.C. §102(b) as being anticipated by Banin, WO 03/297904. According to the examiner, pages 12-14 of Banin disclose nanorods formed in solution (are not grown using the VLS method) and therefore may have a (M) on both sides due to the fact that both sides of the rod are free. This rejection is believed to be obviated by the amendment to claim 59 to positively recite that the elongated structure element (e.g., rod) has at least two end portions, where each end portion is coupled (not free) to a corresponding nanozone (resulting in two or more nanozones). The applied Banin reference does not disclose a nanostructure having two or more nanozones, one at every end of the nanostructure. This distinction appears to have been recognized by the examiner because claim 87 (now cancelled), dependent from claim 59 and directed to two end portions, each coupled to a nanozone, is not subject to this §106(b) anticipation rejection.

With regard to method claims 68-74, the examiner relies on pages 12-14 of Banin for anticipation. However, Banin's process disclosed on pages 12-14 indicates that the metal nanodrops, which are used as seeds from which the nanorod grow, permit only a one dimensional rod growth via a solution-liquid-solid mechanism (SLS method). It would be well appreciated by one of ordinary skill in the art that Banin's method relied upon

by the examiner does not permit the formation of a rod having both of its ends bonded to nanozones of a different material. As the SLS mechanism disclosed in Banin requires the addition or the *in situ* formation of metal nanoparticles, as catalysts for rod growth, one of ordinary skill in the art would clearly recognize that the formation of nanoparticles, such as nanodumbells, by employing the teachings of Banin would not be possible. Accordingly, Banin cannot anticipate the presently claimed invention.

Reconsideration and withdrawal of the rejection are therefore respectfully requested.

Claims 61, 72 and 89 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Banin in view of Majumdar et al., US 2002/0175408. This rejection is respectfully traversed.

Neither Banin nor Majumdar discloses a nanostructure having two or more nanozones, one at every end of the nanostructure. In addition, neither Banin nor Majumdar discloses a nanostructure selected from a nanodumbell (bipod), a tripod and a tetrapod. Without such a disclosure, teaching or suggestion in either Banin or Majumdar, one of ordinary skill in the art would not be led by the combination of Banin and Majumdar to the presently claimed invention.

Reconsideration and withdrawal of the rejection are therefore respectfully requested.

Claims 81, 84, 86 and 87 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Banin in view of Mayer et al., WO 03/091458. This rejection is respectfully traversed.

Rejected claims 81, 84 and 86 all ultimately depend from claim 59 and so the deficiencies of Banin as discussed above are also applicable here.

Regarding the secondary Mayer reference, the examiner indicates that Mayer discloses nanorods having gold tips on both sides and takes the position that it appears a metal/semiconductor/metal/semiconductor/metal…etc. (multilayered) nanorod may be formed. However, it is clear to one of ordinary skill in the art that Mayer is not teaching the formation of nanoscale nanorods because Mayer specifically teaches at page 7, lines 21-22, that the term "nanorod" is defined as "a rod-like structure having a nanometer diameter and a micron size length" (NOT nanometer size length). As further evidence that Mayer's nanorods are of micron size length, the nanowire illustrated in Fig. 3h is clearly a few microns in length. Accordingly, Mayer's nanorods do not meet the requirement that the elongated structure element (rod) is 100 nm or less in length, as positively recited in claim 59, from which rejected claims 81, 84 and 86 ultimately depend. Furthermore, the multilayered nanorods of Mayer cannot be regarded as having "end portions, each being coupled to a

corresponding nanozone" because the continuous multilayers cannot be regarded by one of ordinary skill in the art as end portions.

Mayer's nanorods are also produced by the vapor-liquid-solid (VLS) method as taught at page 19 of Mayer, where it is stated:

> The synthetic approach of the invention producing the nanorods may use template replication procedures where metals are electrodeposited and semiconductors are grown via vapor-liquid-solid (VLS) deposition in mesoporous membranes fabricated by anodization of Al to Al_2O_3…. The pore diameter and spacing can be varied and has been used to produce wires with diameters ranging from 30-300 nm and lengths of <u>1-10 µm</u>. (emphasis added)

With respect to the VLS method employed by Mayer, applicants respectfully point out the following:

1. A person skilled in the art would appreciate that the templating method of Mayer uses fabricated trenches of specific depth and width that define the length and diameter of the particles to be formed therein. The process of fabricating these features typically involves patterning a photoresist layer and then using the photoresist as a mask while the pattern is etched into one or more underlying layers. One characteristic of such features (trenches), especially those in a deep trench (DT) pattern, is a high aspect ratio in which the height of the trench is several times the width of the opening. Typically, the length is of a few microns and the diameter is of a few to hundreds of

nanometers. This relationship requires low edge roughness and high etch resistance in the photoresist so that smooth sidewalls can be formed in the etched trench pattern. Furthermore, the etch should be anisotropic and be able to generate vertical profiles in the etched pattern. Another challenging aspect is the filling of the trenches via the opening with a uniform layer of material that is free of voids and seams. This process is rather difficult as a continuous filling absent of voids and seams is rather difficult to achieve.

2. The disclosure by Mayer that nanometric nanorods may also be produced are not substantiated by any example. In fact, all examples provided in Mayer lead to the conclusion that the length of the nanorods could not have been controlled by the VLS method. Mayer is not interested with the length of the nanorods but rather with their diameter. This is why the templating method is useful because templating does not limit the length of the produced rod but rather its diameter. The process of Mayer does not permit the manufacture of "short" nanorods, 100 or less nm in length. A person of ordinary skill in the art would appreciate that while the templating method employed by Mayer defines the diameter of the resulting rods, it cannot *a priori* limit the length of the rods, as the vapor deposition cannot be accurately arrested to form rods of no more than 100 nm in length.

3. As indicated in response to the last Office Action, vapor deposition methods, including those employing template methodologies, result in vapor penetration or coating of all chemical components, including the seed material. In one of the original publications by Wagner et al., "The Vapor-Liquid-Solid Mechanism of Crystal Growth and Its Application to Silicon", *Transactions of the Metallurgical Society of AIME*, vol. 233, 1053-1064, (1965), Wagner, a leader in the development of the VLS method, explains that the terminal (made of the seeding material) "was not definitely identifiable from the main crystal except by shape." This is an inherent characteristic of the VLS method, namely that a distinct nanozone of a different material cannot be formed, as the external coating of the nanorod (as a particle) is of the material which is vaporized last. A copy of this Wagner et al. (1965) publication is attached hereto.

In light of all the above considerations and distinctions, Banin in combination with Mayer simply cannot lead one of ordinary skill in the art to a self assembled construct of a plurality of nanostructures, each nanostructure having at least one elongated structure element of 100 nm in length or less and at least two end portions, each of which is coupled to a corresponding nanozone.

Reconsideration and withdrawal of the rejection are therefore respectfully requested.

In view of the above, the claims comply with 35 U.S.C. §112 and define patentable subject matter warranting their allowance. Favorable consideration and early allowance are earnestly urged.

Respectfully submitted,

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